TEXAS AGRICULTURAL EXPERIMENT STATION

BULLETIN NO. 210 JANUARY, 1917

Barns for Work Animals.

B. YOUNGBLOOD, DIRECTOR,
COLLEGE STATION, BRAZOS COUNTY, TEXAS.

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BY

B. YOUNGBLOOD, Director.

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AUSTIN, TEXAS
VON BOECKMANN-JONES CO.
1917

AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS

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*As of February 1, 1917.
**In cooperation with United States Department of Agriculture.

BARNS FOR WORK ANIMALS.

BY

B. YOUNGBLOOD, DIRECTOR.

In constructing a barn for work stock, there are some general considerations which hold good in one climate as well as in another. The purpose of a barn is to house animals and feeding stuffs sufficient for a year's feeding. The arrangement of a barn should be as convenient as possible. It should be reasonably comfortable all the year round. It should be neither unattractive nor too attractive. In this respect it should conform to the other buildings and the farm in general. It should be remembered, however, that either the horse or his owner must pay rent in terms of interest and depreciation on stall and the storage space required for the feeding stuff. If the barn is to be moderate in cost, the horse pays the rent; if the barn is high-priced, the owner must pay it. In determining how much shall be spent upon a barn, therefore, the farmer should decide whether he or the horse is to pay the barn rent.

If the barn is so constructed as to afford an amount of storage space for grain and forage not to be fed to the animals in the building, but to be fed to other animals on the farm, or to be sold, the cost of this additional space should not be charged against the keeping of the work stock. Satisfactory barns, large enough only for the work stock and a year's supply of feeding stuff, can be constructed in Texas at a cost of twenty-five to fifty dollars per animal. If as much as one to three hundred dollars per animal is put into the barn, a proportionate amount of extra storage space for additional hay, grain, seeds, and so forth, may be had at less additional cost than would be the case if a separate storage building were constructed.

While the general principles of barn construction in the North are practically the same as in the South, there is a good deal of difference in the actual method of construction, due to the climatic conditions. In the colder climate comfort is secured by constructing the barn in such a manner as to keep out the cold and keep in animal heat. The necessary closeness of Northern barns makes it difficult to properly ventilate them both in winter and in summer. In the South the matter of ventilation is an easy one, the main problem being to construct the building in such a manner as to secure an abundance of ventilation throughout a large part of the year and to break the north wind in winter. Obviously barns may be of cheaper construction, therefore, in the South than in the North.

Before building a barn the farmer should carefully consider his particular needs, and after satisfying himself that he knows what he

wants, build accordingly. Many farmers have made the mistake of saving money in order to build the biggest and finest looking barn in the neighborhood. It is, of course, poor economy to start this class of competition, but it is good practice to see who can get the best and most satisfactory barn for a given amount of money.

STRENGTH IS ECONOMY.

As a rule barns are constructed too weak to stand every strain to which they are subjected. It frequently happens that as soon as a barn is filled with hay and grain, the sides bulge, the foundations settle irregularly, or a joint breaks, all because the material used is not of proper dimensions to stand the strain. A force not always considered is wind pressure, which may be overcome by bolting the barn down to the foundation and proper braces in walls and roof. Anyone having used a barn a great deal has developed a pretty reliable set of ideas as to how strong a barn must be and doesn't have to be convinced of the necessity of putting sufficient materials and workmanship into it to enable it to stand up under all conditions. In connection with the plans herein presented, the writer has depended upon an architect for material and design of structure. The plans are taken from satisfactory barns on the experiment farms.

The object of this bulletin is primarily to cause the farmer to think long and seriously before he builds. It is not intended that the plans suggested herein shall be followed blindly. They should be modified as necessary, to suit the individual needs of a given farm, as follows:

(1) The walls may be made higher;

(2) The stalls may be increased or decreased in number or width;

(3) Any surplus space saved by reducing the size of the stalls may be used as a granary or harness room; the width of all hallways and feed alleys may be increased as desired, but to do so is not advisable, as such changes would necessarily increase the cost;

(4) The barns may be made longer or shorter as desired.

The plans given herein begin with the cheapest possible, and end with a moderate-priced structure. The chief difference is in the size, convenience in feeding, and the amount of extra storage space supplied. No general-purpose barn plans are given, for the reason that it is better under Southern conditions to have special-purpose buildings, separate and apart. General-purpose barns are used more commonly in the North, where the farmer's comfort in doing chores is more to be considered.

FOUNDATIONS.

It is important that the barn be permanently anchored to the foundation. There is no foundation so satisfactory as one of reinforced concrete. If this material is used, the anchoring can be done by setting one-half-inch bolts four to six feet apart in the foundation, and by fastening them to the sills with nuts and washers.

Concrete consisting of one part of cement, two parts of sharp sand,

and five parts of crushed rock or clean gravel, should be used. This is what is known, ordinarily, as a "1:2:5" or a "1:7 mix." Concrete of this composition can be contracted for at about eight dollars a cubic yard. These figures are based upon the assumption that all materials are to be purchased. If sand and gravel are available on the farm, the expense of hauling from the railway station will not be incurred, and the total cost, of course, will be reduced accordingly. Then, too, if old iron pipes, rods, and so forth, are used for reinforcing, the cost will be further reduced.

Where sharp sand and clean gravel are available on the premises and blocks would have to be purchased, the concrete foundation is not only preferable, but fully as cheap, if not actually cheaper.

STALLS.

On some farms where stallions, jacks, or brood mares are kept, a box stall may be necessary. The box stall should be at least ten feet wide, and of the usual length of a stall, including the alley-way. It should be lined with two-inch lumber, and should be separated from other stalls by tight walls.

Stalls for work stock may vary in width from four and one-half to seven feet. The narrower stalls are not so convenient either in handling the stock or in bedding them down. The wider stalls are more satisfactory all round, but, of course, materially increase the cost of the barn per animal.

FEED ROOM.

One room on the first floor of the barn should be used as a feed mixing room, as shown in plans for the six-stall barn. It is a good idea to plan bins overhead with chutes leading into the mixing room. Immediately under the chute there should be a large box, say three feet deep, four feet wide, and ten or twelve feet long, the dimensions depending upon the amount of feed to be mixed. Space for the storage of grain and other concentrates should be partitioned off from the mixing room.

There are two types of reinforced concrete foundations, namely, *piers* and *continuous*. (See Figures 8 and 18.) Though piers are in many respects satisfactory, the continuous foundation is preferable. It affords a better anchor for the buildings, prevents currents of air from coming under the sills in winter, and makes it more easily possible to control rats and mice. The size of the foundation will depend, of course, upon the amount of load it must carry and the nature of the subsoil. Very little foundation will be required if solid rock is near the surface. In sandy subsoils, it may be necessary first to drive piling down, but there will be few instances where this will be the case. In heavy clay subsoils, a continuous foundation for an average-sized barn should be placed in an excavation about twenty-two inches deep, and should extend six inches to a foot above the surface. A layer of sand

or cinders four inches thick should be placed in the bottom of this excavation and thoroughly tamped before the concrete is poured.

The estimated cost of both continuous and pier foundations will be found in the bills of material.

If wood is used for piers, Bois d'Arc is to be preferred. Bois d'Arc blocks may be purchased of lumbermen at from fifty to seventy-five cents each. The second choice is cedar, and the third is oak. If oak blocks are used, it is best to paint them with hot tar or "pitch," and it is advisable thus to paint even the Bois d'Arc and cedar blocks.

HAY CARRIERS.

In small barns of four to six stalls, a hay carrier is hardly necessary, but one should be installed in a larger barn. It is assumed that it is unnecessary to describe such a device. Various types of hay carriers are advertised in the farm papers, or can be ordered through hardware dealers. Illustrated literature will be furnished by manufacturers upon request.

HAY CHUTES.

Leading from the hay mow into the manger of each stall there may be a hay chute, such as is provided for in the plans of the first two barns shown herein. It is doubtful, however, if the increased convenience of feeding hay through such chute is not more than offset by the loss of space which would be occasioned in the hay mow. In the more recently constructed horse barns the Experiment Station has left out the chutes altogether, in order to obviate the necessity of cutting and keeping open so many holes in floor of the hay mow.

The following pages contain bills of materials and lumber necessary for the construction of various sized barns for work animals planned in acordance with the foregoing suggestions.

In a publication of this kind it is impossible to make accurate estimates as to the cost of the materials and labor. In computing cost of materials, therefore, the lumber has been figured at an arbitrary price of $27.50 per thousand feet, which is probably a lower figure than can be secured at lumber yards at the present time. The figures shown are extremely tentative and the bills of material should be refigured in accordance with quotations which may be had from local lumbermen and hardware dealers.

No estimates as to the cost of labor are attempted, as it is assumed that the farmer will, in many cases, do the building himself.

The following bills of material are for a barn planned for eight mules. (See Figures 1-8, inclusive):

Lumber.		Board Feet
10 pieces	2 x 4—12, No. 1	80
76 "	2 x 6—12, "	932
14 "	2 x 6—14, "	196
120 "	2 x 6—16, "	1920
74 "	2 x 6—18, "	1332
47 "	2 x 6—20, "	940
2 "	2 x 6—22, "	44
8 "	2 x 6—24, "	192
25 "	2 x 8—20, "	667
2 "	2 x 8—16, "	43
2 "	2 x 12—16, "	64
31 "	2 x 12—14, "	868
31 "	2 x 12—18, "	1116
1 "	4 x 6—20, "	40
10 "	6 x 6—18, "	540
1 "	4 x 4—10, "	13
1 "	4 x 4—16, "	21
13 "	1 x 12—12, "	156
4 "	1 x 12—16, "	64
6 "	1 x 12—20, "	120
4 "	1 x 10—12, "	40
3 "	1 x 8—16, "	32
6 "	1 x 5—10, "	25
6 "	1 x 5—12, "	30
4 "	1 x 5—16, "	27
14 "	1 x 5—18, "	105
14 "	1 x 5—20, "	117
11 "	1 x 6—12, "	66
62 "	1 x 6—14, "	434
66 "	1 x 6—16, "	528
8 "	1 x 6—18, "	72
16 "	1 x 6—20, "	160
Drop siding No. 117	"	3600
D. & M. flooring	"	2400
D. & M. flooring	23—1 x 4—14, No. 1	108
D. & M. flooring	18—1 x 4—16 "	96
D. & M. flooring	10—1 x 4—10 "	33
Shiplap No	2—1 x 8	2300
	58—1 x 4—10 No. 1	190
	83—1 x 4—12 "	332
	4—1 x 4—16 "	21
	1 x 4 No. 2	1760
Total		21,744

To 21,744 board ft. lumber at $27.50 per M $597.96

Other material:	
66 feet 12-inch galvanized iron ridge roll, at 12 cents foot	$ 7.90
14 pairs 8-inch strap hinges, at 25 cents pair	3.50
48 feet barn door track, at 12 1-2 cents foot	6.00
8 barn door hangers, at $1.25 each	10.00
80 one-half by 8-inch bolts, at 5 cents each	4.00
500 pounds nails, at $4.50 per 100 pounds	22.50
6 single-sash, 6-light, glass 12 x 14 inches, windows, at $1.50 each	9.00
4 check rail windows, 12-light, glass 12 x 14 inches, at $3.00 each	12.00
32,000 shingles, at $4.00 thousand	128.00
3,000 square feet No. 1 shiplap, at $25.00	75.00
Total	$ 277.90

Foundation:

Continuous concrete:	
8 cubic yards sand, at $1.25 per yard	$ 10.00
50 barrels cement, at $2.00 barrel	100.00
55 cubic yards sand and gravel, at $1.35 per yard	74.25
Total	$184.25

Concrete piers:	
Forty piers, 9 x 9 x 18 inches, footings 18 x 18 x 12 inches.	
Three cubic feet concrete in each pier.	
8 cubic yards sand and gravel, at $1.35 per pard	$ 10.80
6 barrels cement, at $2.00 barrel	12.00
Extra lumber for sills:	
16 pieces 6 x 6—12—576 ft.,	
6 pieces 6 x 6—16—288 ft.—864 feet,	
at $27.50 per thousand	23.75
Total	$ 46.55

Bois d'Arc blocks:	
40 Bois d'Arc blocks, at 25 cents each	$ 10.00
Extra lumber for sills:	
16 pieces 6 x 6—12 ft.—576 ft.,	
6 pieces 6 x 6—16 ft.—288 ft.,—864 feet	
at $27.50 per thousand	23.75
Total	$ 33.75

The following figures show the cost of the barn, any one of the three types of foundation being used:

Continuous concrete foundation.	
Lumber	$ 597.96
Other material	277.90
Foundation	184.25
Total	$ 1.060.11
Concrete piers foundation.	
Lumber	$ 597.96
Other material	277.90
Foundation	46.55
Total	$ 922.41
Bois d'Arc blocks foundation.	
Lumber	$ 597.96
Other material	277.90
Foundation	33.75
Total	$ 909.61

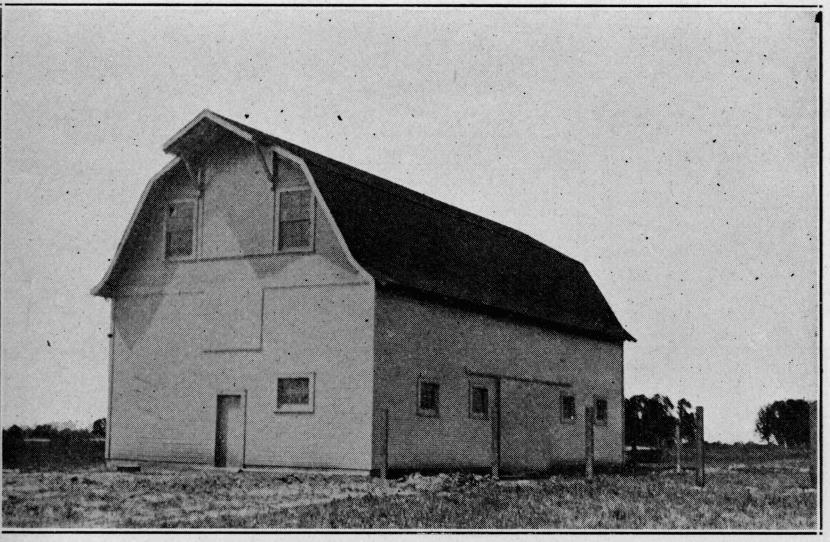


Figure 1—End view of barn with eight stalls, using siding for walls. Main Experiment Station Farm, College Station.

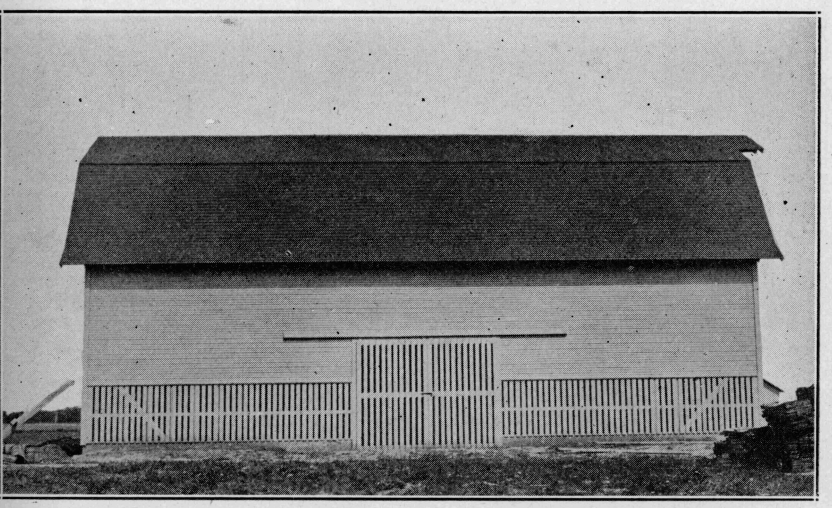


Figure 2—Side view of barn with eight stalls, using siding for walls. Main Experiment Station Farm, College Station.

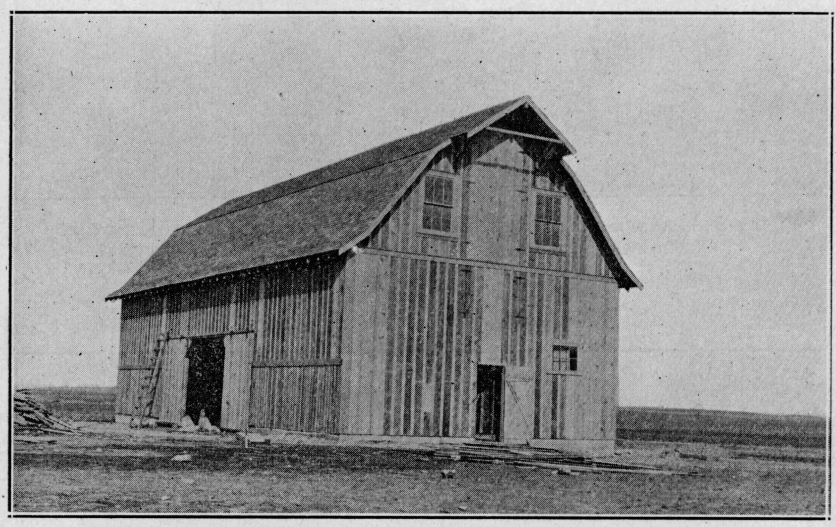
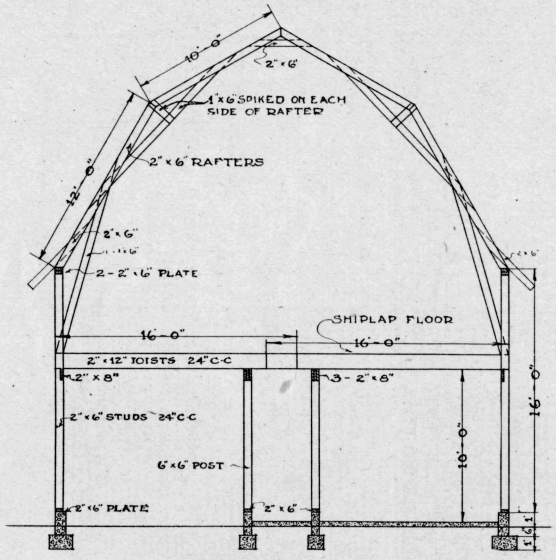
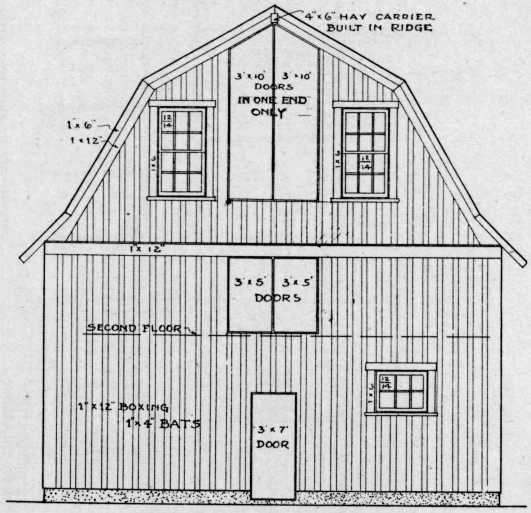


Figure 3—End view of barn with eight stalls, using boxing for walls. Substation No. 6, Denton.



SECTION DRAWING SHOWING FRAMING
SCALE ¼"=1'-0"



EAST END ELEVATION
SCALE ¼" = 1'-0"
BOTH ENDS ALIKE EXCEPT HAY CARRIER AND LARGE HAY DOOR ONLY AT ONE END

Figure 4—Framing detail and east end elevation of barn with eight stalls.

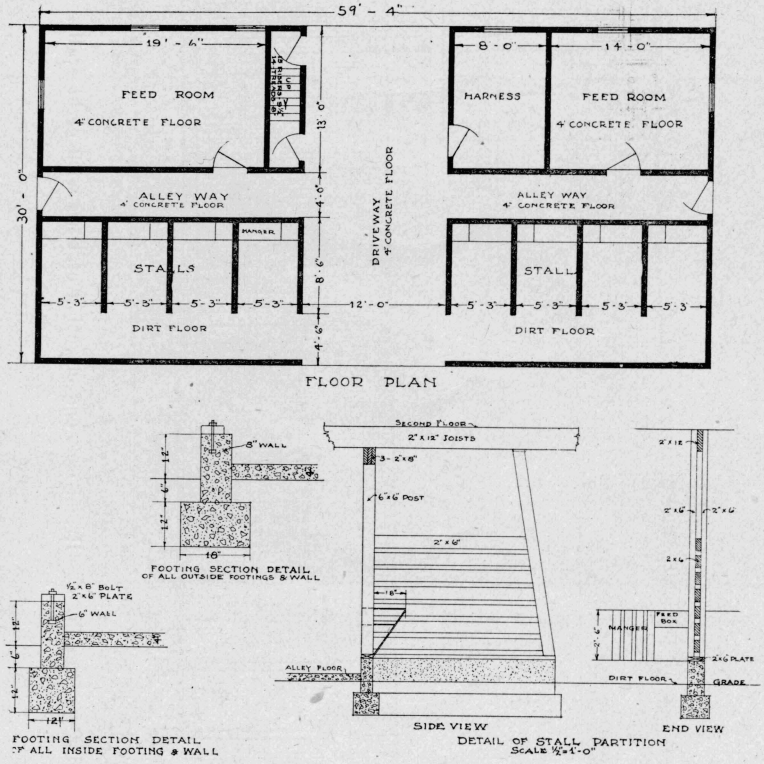


Figure 5—Floor plan and details of footing, wall and steps of barn with eight stalls.

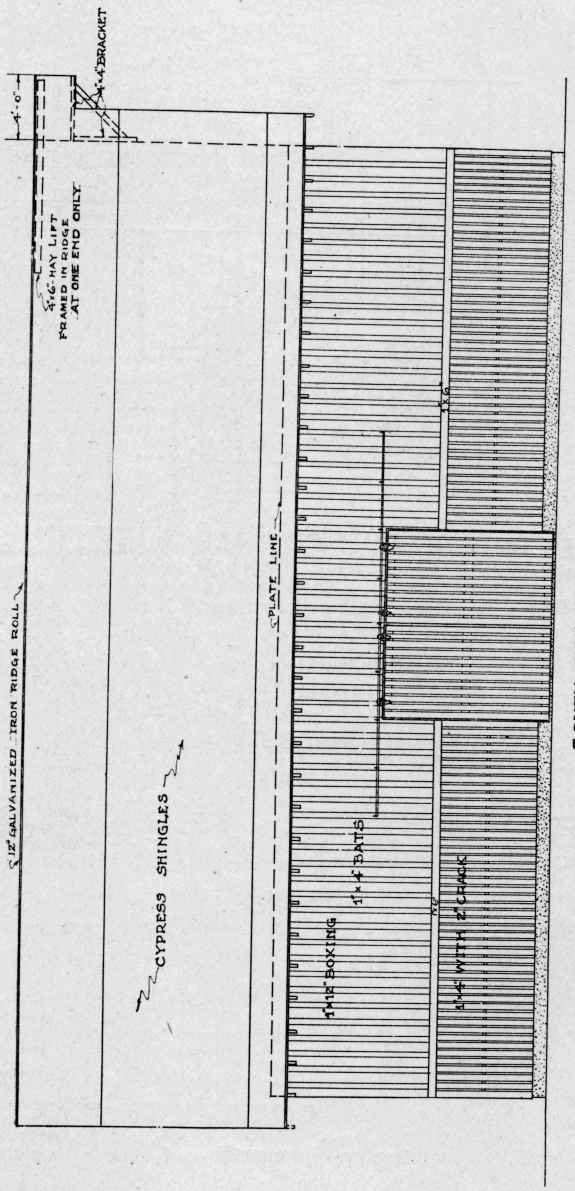


Figure 6—South side elevation of barn with eight stalls.

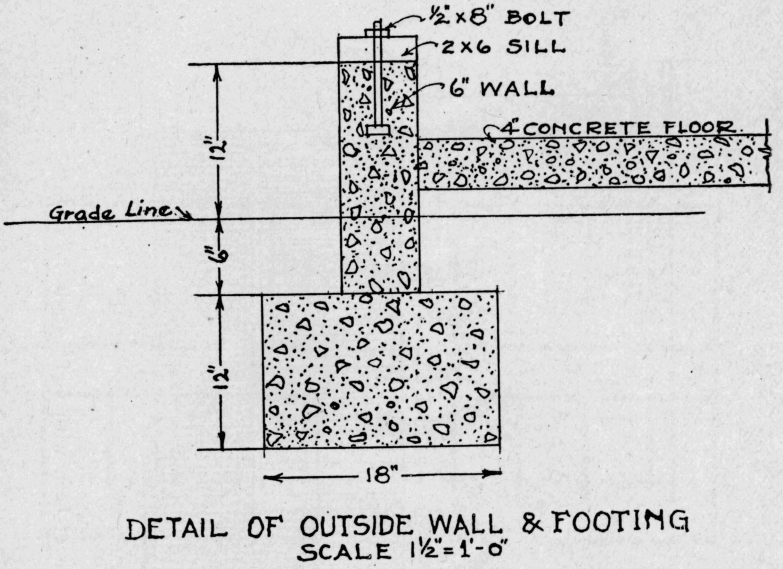


Figure 7—Detail of outside wall and footing in barn with eight stalls.

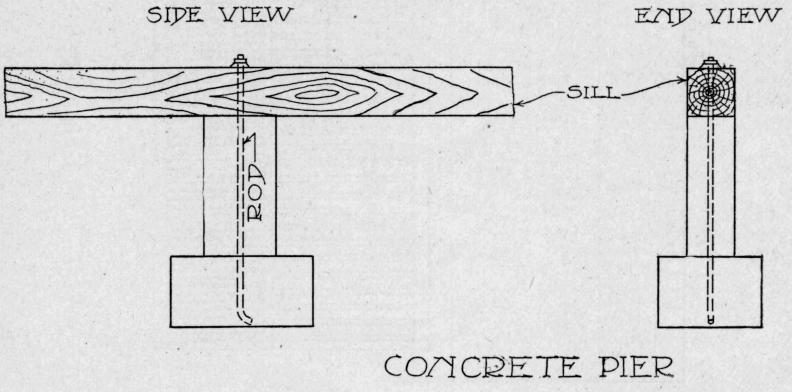


Figure 8—Detail of concrete pier in foundation of barn with eight stalls.

The following bills of material are for a barn large enough for six mules. (See Figures 9-13, inclusive):

Lumber.	Board Feet.
32 pieces 2 x 6—14, No. 1 Common	448
36 " 2 x 6—16, "	576
70 " 2 x 6—12, "	840
22 " 2 x 6—18, "	396
22 " 2 x 6—22, "	484
20 " 2 x 4—10, "	134
42 " 2 x 10—14, "	980
18 " 2 x 10—12, "	360
50 " 1 x 6—16, "	400
100 " 1 x 6—12, "	600
200 " 1 x 4—14, "	934
4 " 6 x 6—10, "	120
4 " 6 x 6—14, "	168
64 " 1 x 12—12, "	768
20 " 1 x 12—10, "	200
20 " 1 x 12—16, "	320
20 " 1 x 4—10, O. G. Bats	67
30 " 1 x 4—16, O. G. Bats	160
1800 ft. shiplap	1800
Total	9,755

To 9,755 feet lumber, at $27.50 per thousand feet ..... $ 268.25

Other material:	
300 pounds nails, at $4.50 per 100 pounds	$ 13.50
40 one-half by 8-inch bolts, at 5 cents each	2.00
2 door hangers, at $1.25 each	2.50
12 feet barn door track, at 12 1-2 cents foot	1.50
4 pairs 8-inch strap hinges, at 25 cents pair	1.00
3 plain rail 12-light windows, at $3.25 each	9.75
17,000 shingles, at $4.00 thousand	68.00
Total	$ 98.25

Foundation.

Continuous concrete:	
28 barrels cement, at $2.00 barrel	$ 56.00
25 cubic yards sand and gravel, at $1.35 per yard	33.75
Total	$ 89.75

Concrete piers:	
Twenty-two piers, 9 x 9 x 18 inches, footings 18 x 18 x 12 inches.	
Three cubic feet concrete in each pier.	
5 cubic yards sand and gravel, at $1.35 per yard	$ 6.75
4 barrels cement, at $2.00 barrel	8.00
Extra lumber for sills:	
13 pieces 6 x 6—14 ft.—546 feet, at $27.50 per thousand feet	15.02
Total	$ 29.77

Bois d'Arc blocks:	
22 Bois d'Arc blocks, at 25 cents each	$ 5.50
Extra lumber for sills:	
13 pieces 6 x 6—14 ft.—546 feet, at $27.50 per thousand feet	15.02
Total	$ 20.52

The following figures show the cost of the barn, any one of the three types of foundation being used:

Continuous concrete foundation:	
Lumber	$ 268.25
Other material	98.25
Foundation	89.75
Total	$ 456.25

Concrete piers foundation:	
Lumber	$ 268.25
Other material	98.25
Foundation	29.77
Total	$ 396.27

Bois d'Arc blocks foundation:	
Lumber	$ 268.25
Other material	98.25
Foundation	20.52
Total	$ 387.02

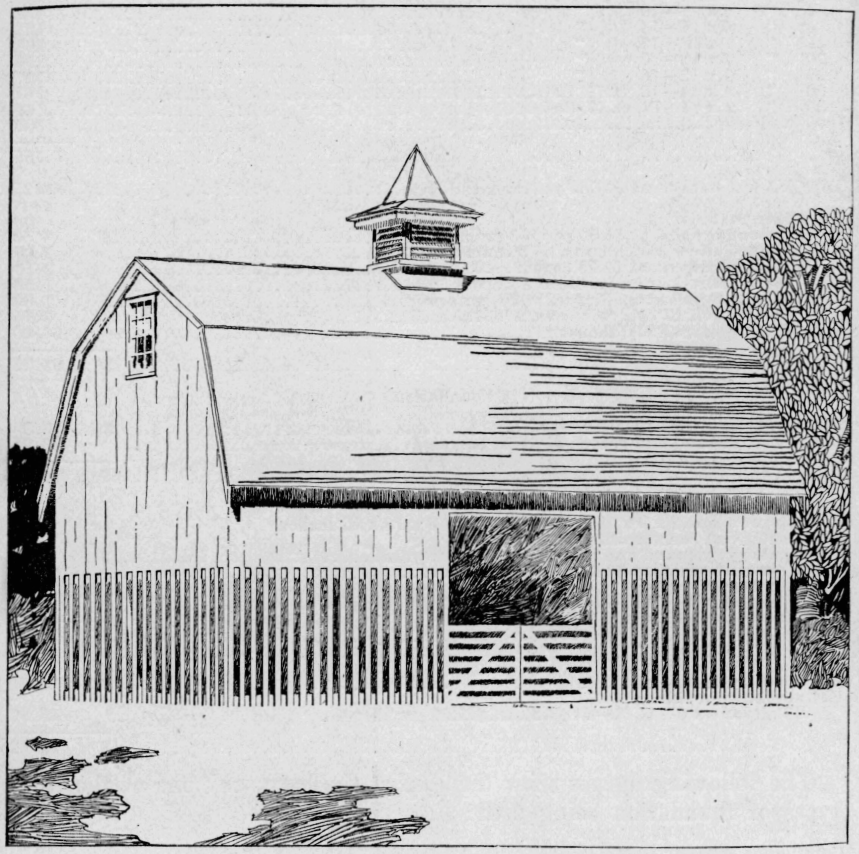


Figure 9—Perspective of barn with six stalls.

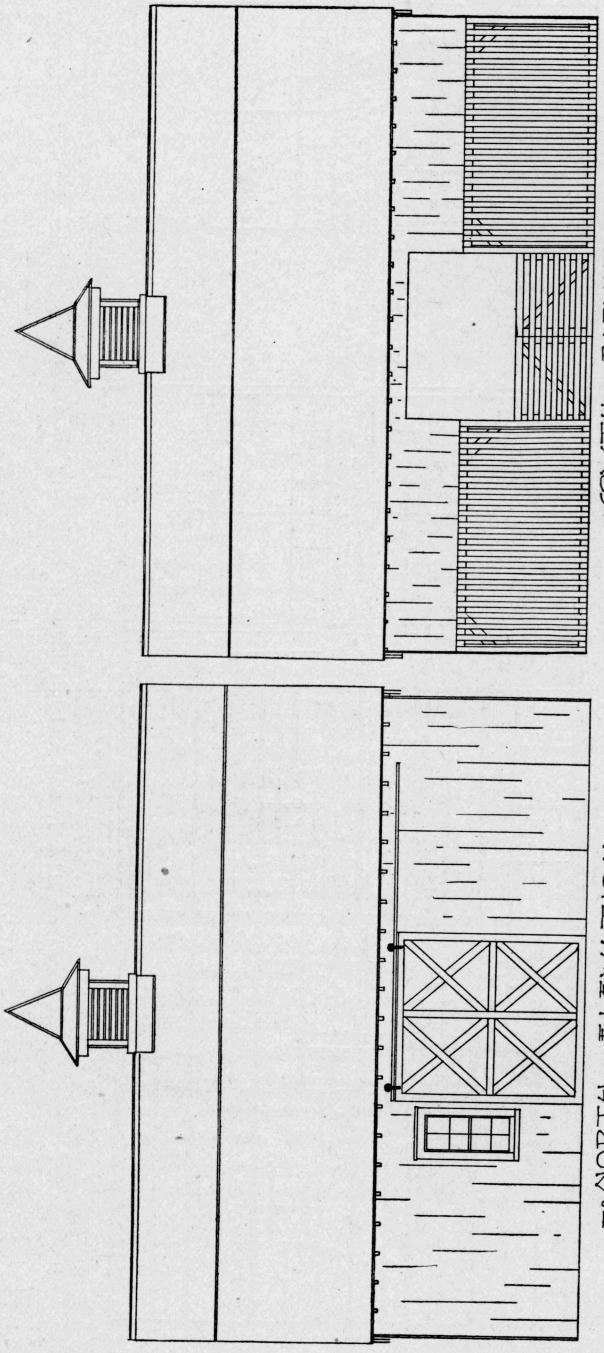


Figure 10—North and south elevations of barn with six stalls.

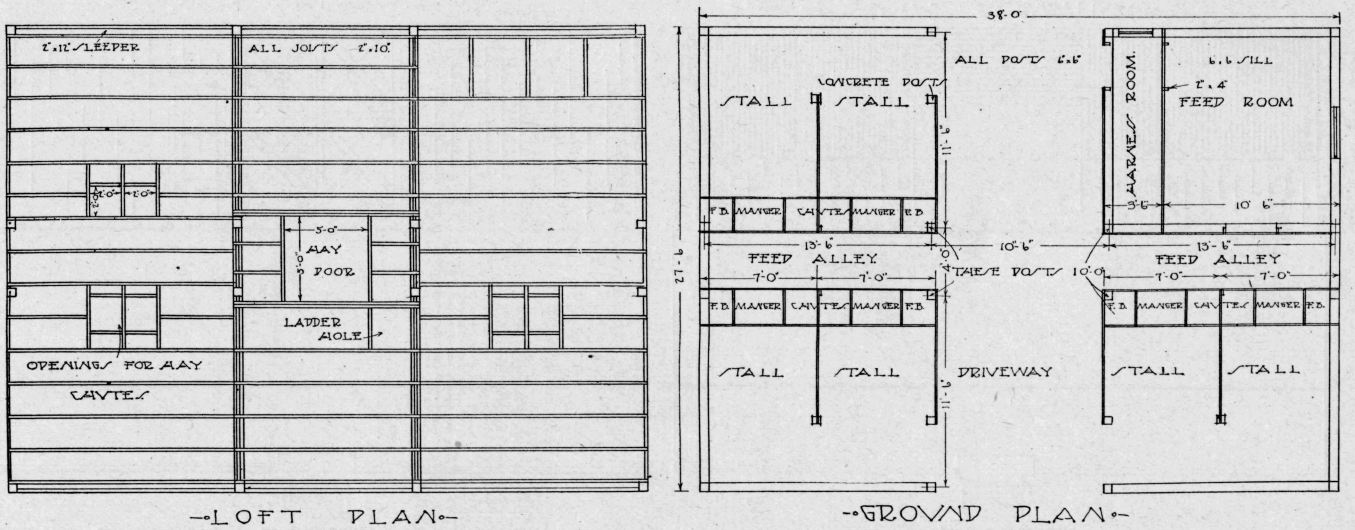


Figure 11—Ground and loft plans of barn with six stalls.

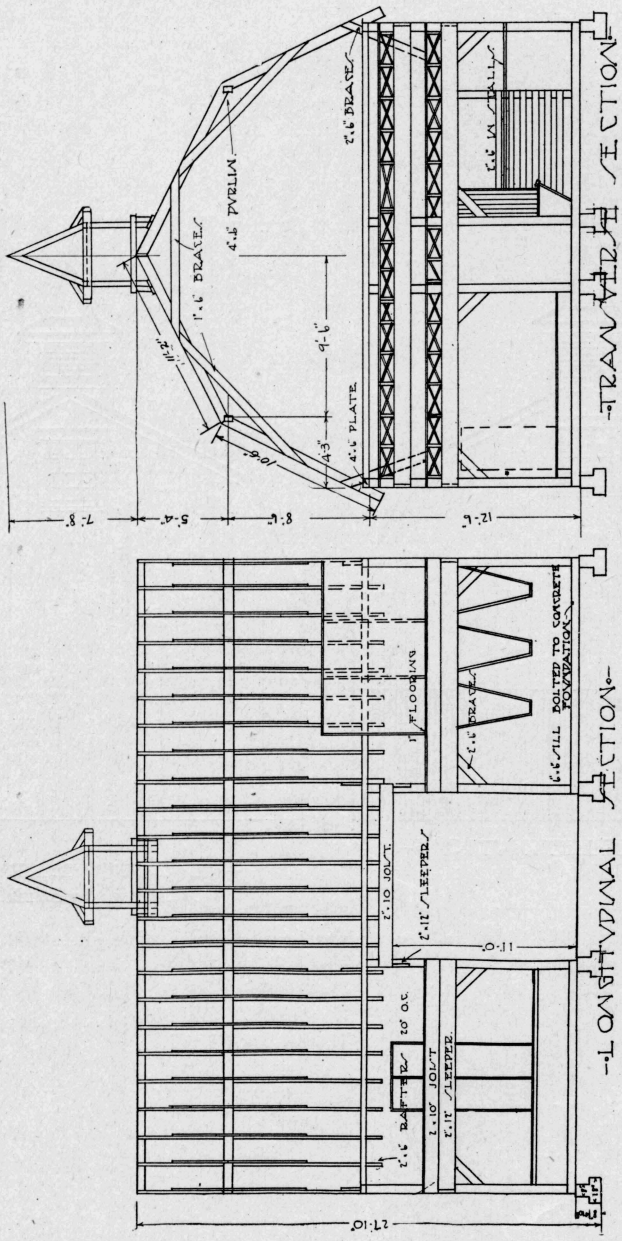


Figure 12—Longitudinal and transverse sections of barn with six stalls.

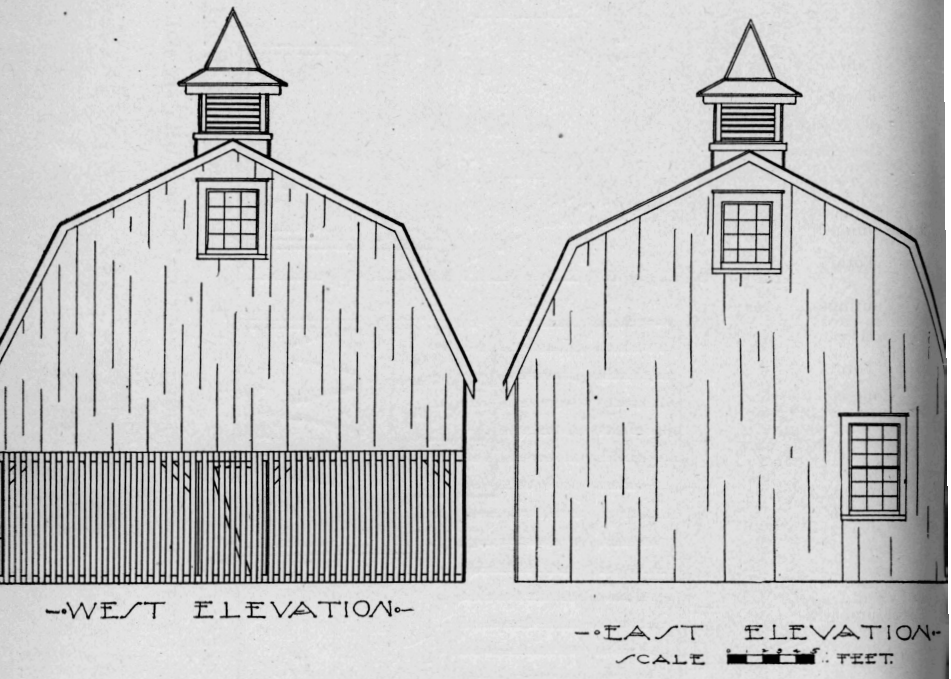


Figure 13—West and east elevations of barn with six stalls.

The following bills of material are for a four-mule barn, suitable for the needs of a small farm. (See Figures 14 and 15.):

Lumber.			Board Feet.
16 pieces	2 x 6—14,	No. 1 Common	224
8 "	2 x 6—12,	"	96
30 "	2 x 6—22,	"	660
50 "	2 x 6—10,	"	500
24 "	2 x 4—10,	"	160
8 "	6 x 6—10,	"	240
6 "	2 x 12—14,	"	168
2 "	2 x 12—16,	"	64
24 "	2 x 10—14,	"	560
30 "	1 x 6—12,	"	180
15 "	1 x 6—10,	"	75
120 "	1 x 4—12,	"	480
40 "	1 x 4—16,	"	214
21 "	1 x 12—10,	"	210
28 "	1 x 12—10,	"	280
20 "	1 x 12—14,	"	280
20 "	1 x 12—16,	"	320
50 "	1 x 4—20,	O. G. Bats	334
40 "	1 x 4—16,	O. G. Bats	214
250 ft.	shiplap		1250
	Total		6,509

To 6,509 board feet lumber at $27.50 per thousand feet	$ 179.00
Other material:	
200 pounds nails, at $4.50 per 100 pounds	$ 9.00
22 feet ridge roll, at 12 1-2 cents foot	2.75
6 pairs 8-inch strap hinges, at 25 cents pair	1.50
25 one-half by 8-inch bolts, at 5 cents each	1.25
,000 shingles, at $4.00 thousand	36.00
Total	$ 50.50

Foundation:

Continuous concrete:	
5 cubic yards sand and gravel, at $1.35 per yard	$ 33.75
4 barrels cement, at $2.00 barrel	48.00
Total	$ 81.75
Concrete piers:	
ourteen piers, 9 x 9 x 18 inches, footings 18 x 18 x 12 inches.	
hree cubic feet concrete in each pier.	
4 cubic yards sand and gravel, at $1.35 per yard	$ 5.40
3 barrels cement, at $2.00 barrel	6.00
xtra lumber for sills:	
5 pieces 6 x 6—12—180 ft.	
4 pieces 6 x 6—16—192 ft.	
3 pieces 6 x 6—14—126 ft.—498 feet, at $27.50 per thousand feet	13.70
Total	$ 25.10
Bois d'Arc blocks:	
Bois d'Arc blocks, at 25 cents each	$ 3.50
xtra lumber for sills:	
5 pieces 6 x 6—12—180 ft.	
4 pieces 6 x 6—16—192 ft.	
3 pieces 6 x 6—14—126 ft.—498 ft., at $27.50 per thousand feet	13.70
Total	$ 17.20

The following figures show the cost of the barn, when any one of the ree types of foundation is used:

ntinuous Concrete Foundation:	
Lumber	$ 179.00
Other material	50.50
Foundation	81.75
Total	$ 311.25
ncrete piers foundation:	
Lumber	$ 179.00
Other material	50.50
Foundation	25.10
Total	$ 254.60
is d'Arc blocks foundation:	
Lumber	$ 179.00
Other material	50.50
Foundation	17.20
Total	$ 246.70

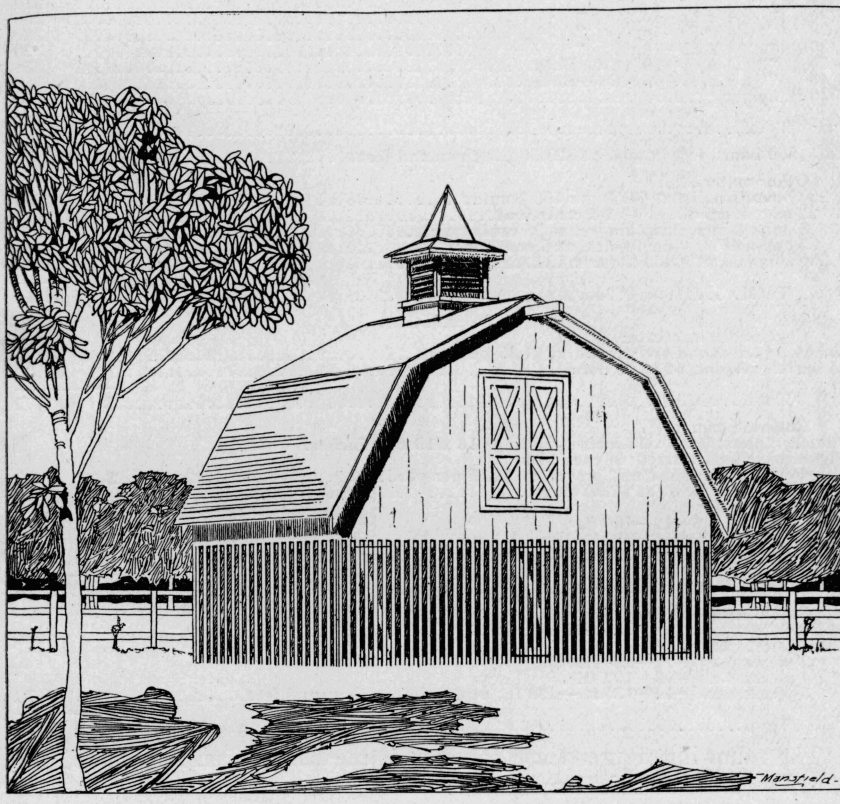


Figure 14—Perspective of barn with four stalls.

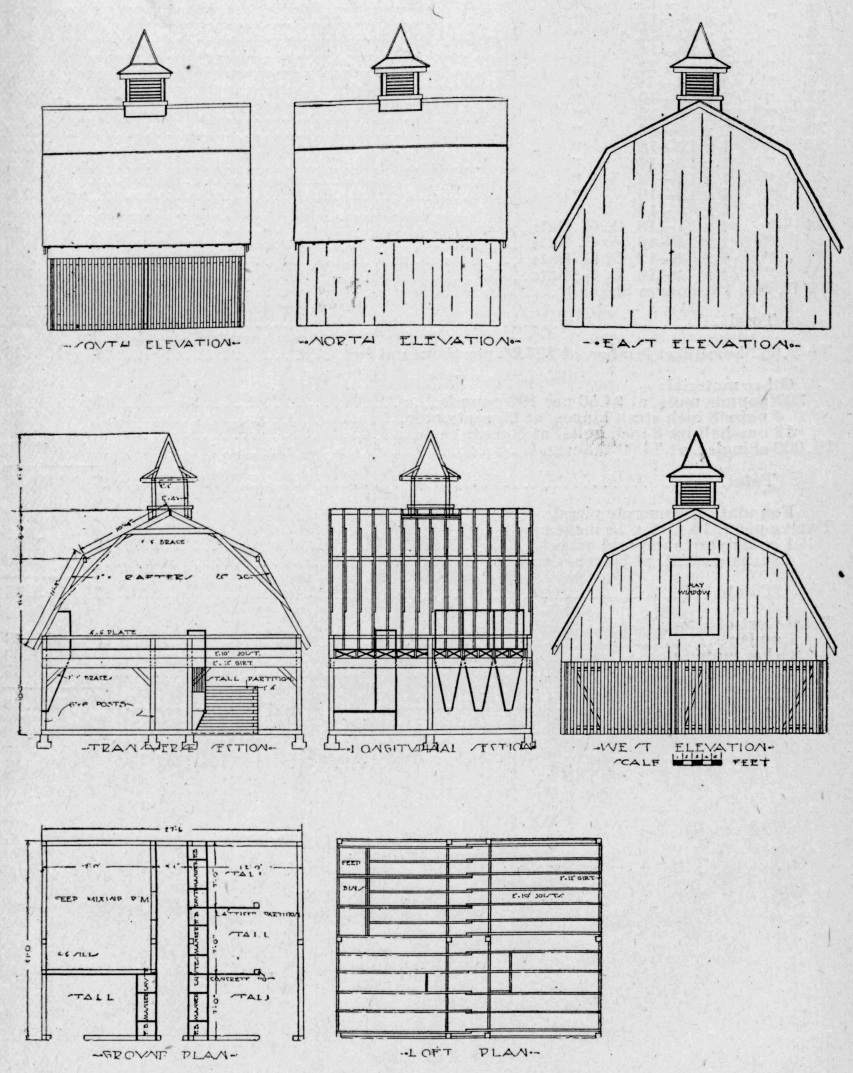


Figure 15—Details of barn with four stalls.

The following bills of material are for a shed type of barn with four stalls, 14x42 feet in size, with loft: (See Figure 16.)

Lumber.		Board Feet.
7 pieces	4 x 6—14, No. 1 Common	196
4 "	4 x 6—12, "	96
9 "	4 x 6—10, "	180
5 "	6 x 6—14, "	210
5 "	6 x 6—12, "	180
8 "	2 x 10—12, "	160
22 "	2 x 10—14, "	514
24 "	2 x 4—22, "	352
8 "	2 x 4—14, "	75
32 "	2 x 4—10, "	214
8 "	2 x 4—12, "	64
20 "	2 x 6—16, "	320
14 "	1 x 12—18, "	252
16 "	1 x 12—16, "	256
42 "	1 x 12—12, "	504
20 "	1 x 12—16, "	320
110 "	1 x 4—14, "	514
14 "	1 x 4—18, O. G. Bats	84
16 "	1 x 4—16, O. G. Bats	86
42 "	1 x 4—12, O. G. Bats	168
20 "	1 x 4—16, O. G. Bats	107
800 ft.	No. 1 Common Shiplap	800
	Total	5,652

To 5,652 board feet lumber, at $27.50 per thousand feet	$ 155.43
Other material:	
200 pounds nails, at $4.50 per 100 pounds	$ 9.00
4 pairs 8-inch strap hinges, at 25 cents pair	1.00
12 one-half by 8-inch bolts, at 5 cents each	.60
10,000 shingles, at $4.00 thousand	40.00
Total	$ 50.60
Foundation (concrete piers):	
Twelve piers, 16 x 16 x 18 inches.	
1 cubic yard sand and gravel	$ 1.35
4 sacks cement, at 50 cents sack	2.00
Total	$ 3.35
Total Cost of Barn:	
Lumber	$ 155.43
Other material	50.60
Foundation	3.35
Total	$ 209.38

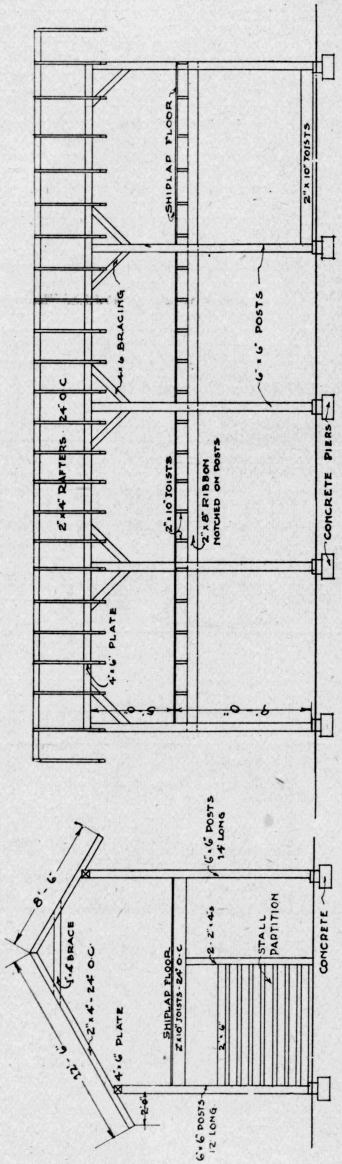


Figure 16—Framing plans of shed-type of barn with four stalls, with loft.

The following bills of material are for a shed type of barn with four stalls, 14x42 feet in size, without loft: (See Figure 17.)

Lumber.	Board Feet.
7 pieces 4 x 6—14, No. 1 Common	196
4 " 4 x 6—12, "	96
9 " 4 x 6—10, "	180
5 " 6 x 6—10, "	150
5 " 6 x 6— 8, "	120
8 " 2 x 10—12, "	160
24 " 2 x 4—22, "	352
4 " 2 x 4—14, "	38
2 " 2 x 4—12, "	16
23 " 2 x 4—10, "	154
20 " 2 x 6—16, "	320
8 " 1 x 12—14, "	112
8 " 1 x 12—10, "	80
26 " 1 x 12—10, "	260
21 " 1 x 12—16, "	336
12 " 1 x 12—12, "	144
110 " 1 x 4—14, "	514
16 " 1 x 4—14, O. G. Bats	75
12 " 1 x 4—12, O. G. Bats	48
26 " 1 x 4—10, O. G. Bats	86
21 " 1 x 4—16, O. G. Bats	112
200 ft. shiplap	200
Total	3,749

To 3,749 board feet of lumber, at $27.50 per thousand feet	$ 103.10
Other material:	
150 pounds nails, at $4.50 per 100 pounds	$ 6.75
10,000 shingles, at $4.00 thousand	40.00
12 one-half by 8-inch bolts, at 5 cents each	.60
1 pair 8-inch strap hinges	.25
Total	$ 47.60
Foundation (concrete piers):	
Twelve piers, 16 x 16 x 18 inches.	
1 cubic yard sand and gravel	$ 1.35
4 sacks cement, at 50 cents sack	2.00
Total	$ 3.35
Total Cost of Barn:	
Lumber	$ 103.10
Other material	47.60
Foundation	3.35
Total	$ 154.05

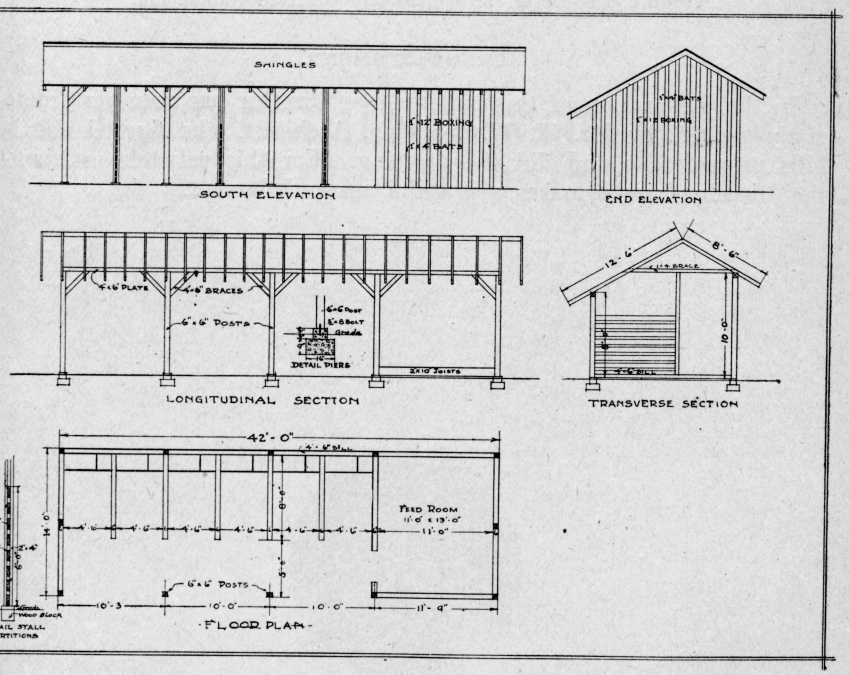


Figure 17—Framing plans of shed-type of barn with four stalls, without loft.

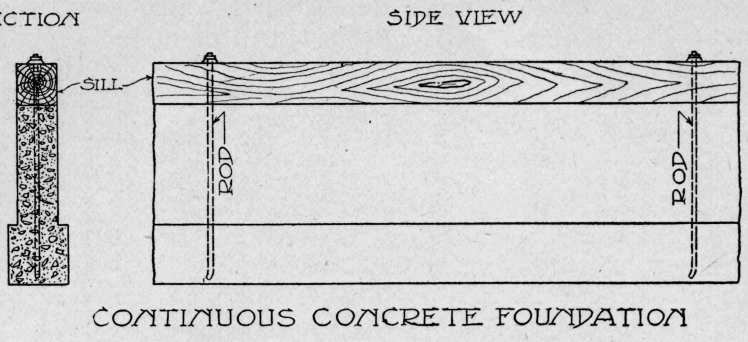


Figure 18—Detail of continuous concrete foundation.

ACKNOWLEDGMENT.

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